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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| EXAMINER |  |
|---|---|
| KERNS, KEVIN P |  |

| ART UNIT | PAPER NUMBER |
|---|---|
| 1725 |  |

DATE MAILED: 07/09/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

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| Office Action Summary | Application No.<br>10/685,951 | Applicant(s)<br>AKERS ET AL. | |
|---|---|---|---|
| | Examiner<br>Kevin P. Kerns | Art Unit<br>1725 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *14 October 2003*.
2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.
3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *31-41 and 43-52* is/are pending in the application.
  4a) Of the above claim(s) _____ is/are withdrawn from consideration.
5)☐ Claim(s) _____ is/are allowed.
6)☒ Claim(s) *31-41 and 43-52* is/are rejected.
7)☒ Claim(s) *31 and 47* is/are objected to.
8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☒ The specification is objected to by the Examiner.
10)☒ The drawing(s) filed on *14 October 2003* is/are: a)☐ accepted or b)☒ objected to by the Examiner.
  Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
  Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
  a)☐ All b)☐ Some * c)☐ None of:
    1.☐ Certified copies of the priority documents have been received.
    2.☐ Certified copies of the priority documents have been received in Application No. _____.
    3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
  * See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
  Paper No(s)/Mail Date *10/14/03*.
4) ☐ Interview Summary (PTO-413)
  Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

## DETAILED ACTION

### *Drawings*

1. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(4) because reference character "16" (in Figure 1) has been used to designate both a mold and a stationary platen (see page 19). In addition, reference character "102" (in Figure 9) has been used to designate both a gate and runner system and a first stage (see pages 22-24). Corrected drawing sheets are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

2. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference character(s) mentioned in the description: nozzle 130 (see page 25). Corrected drawing sheets are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR

1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

3. The drawings are objected to because "74" in Figure 1 is not described clearly in the specification in the last 3 lines of paragraph [0057]. Furthermore, Figures 3-7 contain a substantial amount of text that has not been identified in the specification, including what appears to be data analysis calculations. For example, the term "Von Mises" should be identified in the specification or deleted from Figure 7. Corrected drawing sheets are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective

action in the next Office action. The objection to the drawings will not be held in abeyance.

## *Specification*

4. The disclosure is objected to because of the following informalities: on page 2 of the preliminary amendment, in paragraph [0000.1], ", now abandoned, " should be added after "2001". In the 5th line of paragraph [0024], "greater than 0 to 400 Hz" is unclear, since the majority of frequencies between 0 and 1 Hz extend into an unusable range for operation of the apparatus. In the 1st line of paragraph [0035], "comparative" should be changed to "comparison". In the 2nd line of paragraph [0040], "a mold" should be changed to "mold halves". In the 3rd line of paragraph [0068], "102" should be changed to "106" after "barrel". In the 6th line of paragraph [0068], "sheering" should be changed to "shearing". In paragraphs [0070] and [0071], "sleeve 112" should be changed to "sleeve 122". Appropriate correction is required.

Note: applicants are also referred to the prosecution history of related application 09/861,250 for the majority of the errors described in paragraphs 1-4 above.

## *Claim Objections*

5. Claims 31 and 47 are objected to because of the following informalities: in the 8th line of claim 31, as well as the 7th line of claim 47, "$H_z$" should be changed to "Hz" in both instances. Appropriate correction is required.

## *Claim Rejections - 35 USC § 112*

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. Claims 31-41 and 43-52 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

With regard to claims 31 and 47, it is unclear how the method of heating a metal material would operate without the other type of heaters (resistance band heaters that heat quickly). The slower, more uniform heating provided by the induction heaters would achieve the smaller temperature gradients, but would not likely be used to initiate heating to a high temperature at the beginning of a casting cycle. The applicants are suggested to include both the resistance band heaters and the induction heaters in independent method claims 31 and 47, as it appears to be required in the processes.

## *Claim Rejections - 35 USC § 103*

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

9. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of

the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

10. Claims 31-41 and 43-52 are rejected under 35 U.S.C. 103(a) as being unpatentable over Vining et al. (US 5,983,978) in view of Brueker et al. (US 5,375,645).

Vining et al. disclose a thermal shock resistant apparatus and process for molding thixotropic materials, in which a metal feedstock is delivered into a heated three-section barrel constructed of different materials, in which the heated metal feedstock is engaged/stirred by a rotating (magnetic) screw element prior to ejecting the heated metal from the barrel into a mold (abstract; column 1, lines 7-11; column 4, lines 45-55; column 8, lines 64-67; column 9, lines 1-5 and 20-35; and Figures 1-6). The multi-piece barrel (with associated inlet) is comprised of materials, such as stainless steel, lined with a (non-magnetic) niobium-based alloy, and in turn nitrided, borided, or siliconized, or constructed with a fiber-reinforced composite (high electrical resistivity), to provide good wear resistance during operation (column 4, lines 45-65; column 5, lines 27-67; column 6, lines 1-5; column 11, lines 3-12; column 12, lines 30-42; column 13, lines 2-9; and Figures 1-6). The barrel contains associated heaters, which may be either resistance band heaters or induction heating coils, and further accompanied by a thermal gradient monitoring system, which has thermocouple sensors and temperature controls (abstract; column 6, lines 13-28; column 8, lines 30-49; column 9, lines 6-13; column 12, lines 63-67; column 13, lines 1-9 and 63-65; column 14, lines 30-36; and Figures 1-6). One of ordinary skill in the art would have recognized that the degree of heating would readily be controlled by a plurality of variable frequency induction coil heaters at a desired coil spacing throughout the thermal gradient region, as induction heaters are known in the art to have controllable, variable frequencies dependent on the desired amount of penetration of heating into the molten material to achieve desired temperatures throughout, and further avoid a "skin effect" of the molten metal. It would have been obvious to one of ordinary skill in the art at the time the invention was made to further substitute induction coil heaters in place of resistance band heaters, as induction coils heaters are adjustable to reach the desired temperature more quickly, and the type of power source would readily be chosen by one of ordinary skill in the art depending on the temperature gradient and heating requirements of the thixotropic metal material. The thermal gradient monitoring system is advantageous for minimizing the effects of thermal cycling on the barrel (column 14, lines 30-36). Vining et al. do not specifically disclose the use of a low frequency induction heating of less than 1000 Hz to obtain the low thermal gradient values.

However, Brueker et al. disclose an apparatus and process for producing shaped articles from semisolid metal preforms, in which the process includes providing an induction heating power supply that operates at frequencies from 60 to 400,000 hertz, such that the precise power capability and frequency are selected in accordance with the preform diameter and heating rate required, for the purpose of controlling the temperature gradient as a function of the frequency and size/properties of metal articles to be cast (abstract; column 5, lines 18-68; column 6, lines 1-57; and Figure 1).

It would have been obvious to one of ordinary skill in the art at the time the applicants' invention was made to modify the process for molding thixotropic materials, as disclosed by Vining et al., by using the induction heating power supply that operates at frequencies from 60 to 400,000 hertz, as taught by Brueker et al., such that the precise power capability and frequency are selected in accordance with the preform diameter and heating rate required, in order to precisely control the temperature gradient as a function of the frequency and size/properties of metal articles to be cast (Brueker et al.; column 6, lines 50-57).

11. Claims 31-41 and 43-52 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bradley et al. (US 5,040,589) in view of Brueker et al. (US 5,375,645).

Bradley et al. disclose an apparatus and process for the injection molding of metal alloys, in which a thixotropic alloy is fed into an extruder barrel with a controlled temperature profile assisted by heating means, in which a rotatable extruder screw operates to shear/stir the thixotropic material prior to ejecting the heated metal alloy from the barrel into a mold (abstract; column 3, lines 24-38; column 4, lines 12-28 and 57-67; and Figures 1 and 3). The barrel is preferably bimetallic having an outer shell of a high strength nickel alloy, and a liner of a high cobalt material of high chemical and thermal resistance (column 6, lines 4-15). The screw is made of a (magnetic) hot work tool steel material (column 5, lines 62-65). There are six temperature zones (Z1-Z6) in the heating apparatus that surrounds the outer surface of the barrel, and zone Z2 contains an induction coil heater that has the capacity to supply 25 kw of power, which would be driven by a suitable power supply (column 6, lines 25-68; column 7, lines 1-47; table at the bottom of column 12; and Figure 3). The temperatures are controlled to within 20 degrees in the widest variation of the six heating zones for three different thixotropic alloy materials (table at the bottom of column 12). One of ordinary skill in the art would have recognized that the degree of heating would readily be controlled by a plurality of variable frequency induction coil heaters at a desired coil spacing throughout the thermal gradient region, as induction heaters are known in the art to have controllable, variable frequencies dependent on the desired amount of penetration of heating into the molten material to achieve desired temperatures throughout, and further avoid a "skin effect" of the molten metal. It would have been obvious to one of ordinary skill in the art at the time the invention was made to further substitute induction coil heaters in place of resistance band heaters, as induction coils heaters are adjustable to reach the desired temperature more quickly (drastic heating of zone Z2--column 7, lines 9-11), and the type of power source would readily be chosen by one of ordinary skill in the art depending on the temperature gradient and heating requirements of the thixotropic metal material. These multiple heating zones are advantageous for establishing selected temperatures for different alloys, as well as prevent dendritic crystalline growth (column 7, lines 12-47). Bradley et al. do not specifically disclose the use of a low frequency induction heating of less than 1000 Hz to obtain the low thermal gradient values.

However, Brueker et al. disclose an apparatus and process for producing shaped articles from semisolid metal preforms, in which the process includes providing an induction heating power supply that operates at frequencies from 60 to 400,000 hertz, such that the precise power capability and frequency are selected in accordance with the preform diameter and heating rate required, for the purpose of controlling the temperature gradient as a function of the frequency and size/properties of metal articles to be cast (abstract; column 5, lines 18-68; column 6, lines 1-57; and Figure 1).

It would have been obvious to one of ordinary skill in the art at the time the applicants' invention was made to modify the injection molding process disclosed by Bradley et al., by using the induction heating power supply that operates at frequencies from 60 to 400,000 hertz, as taught by Brueker et al., such that the precise power capability and frequency are selected in accordance with the preform diameter and heating rate required, in order to precisely control the temperature gradient as a function of the frequency and size/properties of metal articles to be cast (Brueker et al.; column 6, lines 50-57).

12. Claims 31-41 and 43-52 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kilbert (US 5,680,894) in view of Brueker et al. (US 5,375,645).

Kilbert discloses an apparatus and process for the injection molding of a metal alloy, in which a thixotropic magnesium alloy is fed into an extruder barrel with a controlled temperature profile assisted by heating means, in which a (magnetic steel) rotatable extruder screw operates to shear/stir the thixotropic material prior to ejecting the heated metal alloy from the barrel into a mold (abstract; column 5, lines 20-28; column 6, lines 22-26; column 7, lines 2-8; and Figures 1 and 2). The barrel is preferably bimetallic having an outer shell of a high strength nickel alloy, and a liner of a high cobalt material of high chemical and thermal resistance (column 7, lines 63-67; and column 8, lines 1-6). There are six temperature zones (Z1-Z6) in the heating apparatus that surrounds the outer surface of the barrel, and zone Z2 contains an induction coil heater adjacent to a substantial length of the barrel, and this coil heater has the capacity to supply 25 kw of power, which would be driven by a suitable power supply (column 8, lines 13-67; column 9, lines 1-31; and Figures 1 and 2). One of ordinary skill in the art would have recognized that the degree of heating would readily be controlled by a plurality of variable frequency induction coil heaters at a desired coil spacing throughout the thermal gradient region, as induction heaters are known in the art to have controllable, variable frequencies dependent on the desired amount of penetration of heating into the molten material to achieve desired temperatures throughout, and further avoid a "skin effect" of the molten metal. It would have been obvious to one of ordinary skill in the art at the time the invention was made to further substitute induction coil heaters in place of resistance band heaters, as induction coils heaters are adjustable to reach the desired temperature more quickly (drastic heating of zone Z2--column 8, lines 61-64), and the type of power source would readily be chosen by one of ordinary skill in the art depending on the temperature gradient and heating requirements of the thixotropic metal material. These multiple heating zones are advantageous for establishing selected temperatures for different alloys, as well as preventing alloy solidification to retain slush morphology (column 9, lines 14-30). Kilbert does not specifically disclose the use of a low frequency induction heating of less than 1000 Hz to obtain the low thermal gradient values.

However, Brueker et al. disclose an apparatus and process for producing shaped articles from semisolid metal preforms, in which the process includes providing an induction heating power supply that operates at frequencies from 60 to 400,000 hertz, such that the precise power capability and frequency are selected in accordance with the preform diameter and heating rate required, for the purpose of controlling the temperature gradient as a function of the frequency and size/properties of metal articles to be cast (abstract; column 5, lines 18-68; column 6, lines 1-57; and Figure 1).

It would have been obvious to one of ordinary skill in the art at the time the applicants' invention was made to modify the injection molding process disclosed by Kilbert, by using the induction heating power supply that operates at frequencies from 60 to 400,000 hertz, as taught by Brueker et al., such that the precise power capability and frequency are selected in accordance with the preform diameter and heating rate required, in order to precisely control the temperature gradient as a function of the frequency and size/properties of metal articles to be cast (Brueker et al.; column 6, lines 50-57).

## *Conclusion*

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dr. Kevin P. Kerns whose telephone number is (571) 272-1178. The examiner can normally be reached on Monday-Friday from 8:00am-5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Dunn can be reached on (571) 272-1171. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Kevin P. Kerns Kevin Kerns 7/7/04
Examiner
Art Unit 1725

KPK
kpk
July 7, 2004